Does schooling foster environmental values and action? A cross-national study of priorities and behaviors

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ABSTRACT

Steering the course of climate change will require coordination and collective action between nations, which are directed not only by the interests of their political leaders and elites but also the values of citizens. Previous studies have investigated macro-level factors that help explain international differences in general environmental concern. The present article draws on the sixth wave of the World Values Survey, which offers researchers an even starker outcome measure than general concern: whether or not environmental protection should be prioritized over economic growth. Here we report on WVS data from 50 countries to show the individual-level and national-level factors associated with respondents' prioritizations of the environment.

1. Introduction

Education is fundamental in the framing of sustainable development and environmental protection, at least so it has been supposed since 1987. Both by informing citizens and through enculcating global norms, it has long been assumed that schooling generates pro-environmental values and behavior. This essay explores the theory and evidence supporting that assumption by analyzing a cross-national survey of adults who reported on their values and environmental actions in fifty countries. Here we draw on the most recent wave of the World Values Survey (WVS) and its measure of whether or not respondents thought that environmental protection should be prioritized over economic growth, and we further examine the association between education and three pro-environmental actions.

We first use WVS responses during the 2010–2014 period to show the individual-level and national-level factors that are associated with respondents' prioritizations of the environment over economic growth. Our main purpose is to identify any net association between respondents' educational attainments and their valuation of the environment after taking into account controls at both the level of the individual as well as their country of residence (national wealth, and extent and type of air pollution). We begin by showing there is no bivariate relation between education and environmentalism that is universal cross-nationally. However, in our multi-level model estimations we do find support for a positive association with education overall.

Of course, offering more education to more children is hoped and

expected to change more than the mere the expression of environmental values. Hopefully, both directly and through changing values, increased education can also alter individual behavior. Within the limits of a single wave of cross-sectional survey data, we therefore try to test this relation. To anticipate, we find support for a conclusion that concern for the environment is more than just an attitude: it is also associated with action and behavior. The connection we find between values and behavior – although already well-established in previous investigations[1] – is additional evidence that changing individual values through education is a precondition for the collective actions needed to steer a new course on climate change.

Although formal education is the main focus for this study, we have also modeled and estimated contextual influences that might affect environmental attitudes and behaviors. Our models control for country wealth, as categorized by the World Bank, because we expected that even highly-educated and well-informed respondents would prioritize economic growth and jobs over the environment if they live in poorer countries. In other words, we expected that respondents' prioritizations of environmental protection over the questionnaire alternative (faster economic growth) would be associated with their nation's economy. We further expected that respondents' prioritization of environment, and their subsequent envirnomental actions, would be associated with their national environmental context. That is to say, just as we hypothesized that citizens in poorer countries would be more concerned about growing their national economy, we also expected that citizens in very polluted countries would be more concerned about their nation's environment.

One way that education might increase prioritization of the environment is by raising the subjective value of a sustainable environment, even if there is no cognitive effect of schooling on the processing of information about the environment. A second way education could raise concern for the environment is because more educated people might better process evidence about the environment, even if they value it no more than do people with less education. In either case we would expect the effects of education on prioritization to be most pronounced in countries doing the most environmental damage. Based on the data available to us in this investigation, both channels should lead to a hypothesis about the way educational attainment interacts with national levels of emmissions of carbon dioxide (CO_2) and particulates (PM2.5). Even if increased emissions do not directly increase environmental prioritization, they might have indirect consequences: more local pollution might accentuate the association between education and prioritization of the environment over economic growth.

But there is a crucial difference between carbon dioxide and particulates as contextual indicators. Previous studies have investigated macro-level factors that help explain international differences in citizens' general environmental concerns.[2] Based on such previous research, we hypothesized there would be no evident relation between environmental prioritization and national production of CO_2 because it is invisible and without obvious local effects. By contrast, the national production of particulate pollution (PM2.5) should be associated with environmental prioritization and environmental action, net of the respondents' educational attainment.

2. Institutions and movements supporting use of education to protect the environment

The context for this investigation is worthy of emphasis: the decades long, previously separate campaigns for universal education and sustainable world development. The UN Development Decade was established in 1961 by resolution #1710 of the General Assembly. To achieve development and increase economic growth, the Secretary General was requested to take "measures to accelerate the elimination of illiteracy, hunger, and disease."[3]; Education advocates, drawing on a variety of theoretical perspectives, saw social and global benefits from equitable, free and universal schooling. Beginning in the 1960s, economists theorized that productivity increased along with the skills associated with further schooling, leading to economic development.[4] In the 1960s, sociologists viewed education as a requisite for individual modernity.[5] In 1969, environmental education was launched as a pedagogy and sub-field in the United States, including the first scholarly journal.

The concept of *sustainable* development gained currency after 1987 through *A Common Future* (the "Gro Brundtland Report"), which argued

for "a vast campaign of education, debate, and public participation."[6]; Five years later, at the Earth Summit in Rio, delegates affirmed that "Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues…. Both formal and non-formal education are indispensable to changing people's attitudes so that they have the capacity to assess and address their sustainable development concerns. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behavior consistent with sustainable development and for effective public participation in decision-making.[7] In 1992 the United Nations adopted its Framework Convention on Climate Change. Article 6, "Action for Climate Empowerment," placed education at the foundation of this international normative framework. Then, in 2015, Article 12 of the Paris Agreement reaffirmed the need for "education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions."

Outside the normative legal framework of UN treaty conventions, there were additional global movements that are relevant to this investigation. In 2000, two parallel and overlapping sets of declarations – Education for All (EFA) and Millenium Development Goals (MDG) – were publically embraced by representatives of most countries as agendas through 2015. EFA did not connect education with climate change, but the MDGs did include environmental sustainability targets along with universal primary education.[8] Neither declaration had the force of international law. Rather, they were intended to effect change via soft power. Some evidence – but also faith – connected school expansion to sustainability. At this faith's apogee, more secondary schooling was prescribed to "save the planet" from environmental destruction.[9]

At the end of the MDG and EFA period in 2015, the United Nations General Assembly voted to embrace 17 new, integrated goals that were aimed at sustainable development and that also moved forward the education goal posts to universal secondary (even though universal primary education had not been reached or was of dubious quality).[10] Three of the specific targets within the SDGs are:

4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education…

4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles…

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

Through the SDGs, the United Nations is trying to integrate – perhaps even reconcile − disparate development targets into a coherent framework for future decision-making. Previously education was considered a route to economic productivity; now it is seen as a path for sustainability. But it is necessary to ask how likely it is that universalizing secondary education will promote development that is sustainable, as opposed to promoting other well-known outcomes of expanded schooling, especially increased income and consumption. The problem, as critics note, is that existing schools can only be part of the solution if they teach the values

[2] Knight, K. W. and Messer, B. L. 2012. Environmental Concern in Cross-National Perspective: The Effects of Affluence, Environmental Degradation, and World Society. *Social Science Quarterly* 93: 521–537. doi:10.1111/j.1540-6237.2012.00846.x. Hao, F. 2016. A Panel Regression Study on Multiple Predictors of Environmental Concern for 82 Countries Across Seven Years. *Social Science Quarterly*. doi:10.1111/ssqu.12237. Franzen, A. and D. Vogl. 2013. Two decades of measuring environmental attitudes: a comparative analysis of 33 countries. *Global Environmental Change* 23:1001–1008. https://doi.org/10.1016/j.gloenvcha.2013.03.009.

[3] UN (1961). Resolution 1710 (XVI): United Nations Development Decade. A programme for international economic cooperation (I). In: United Nations General Assembly – 16th Session. Resolutions adopted on the reports of the Second Committee, (pp. 17–18). New York: United Nations. Retrieved 12 September 2016 from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/1710%20(XVI). The historic roots of these goals are deep. Beginning in the late 18th century, advocates of secular social and scientific progress argued for the benefits of universal education. In the Jeffersonian Republican era of the United States, enlightened citizens were believed to make informed public choices needed for self-government.

[4] Anderson, C.A. and Bowman, M.J. (eds). 1965. *Education and Economic Development*. Chicago: Aldine.

[5] Inkeles, A., & Smith, D.;1; 1974. *Becoming modern: Individual changes in six developing countries*. Cambridge, MA: Harvard University Press.

[6] World Commission on Environment and Development;1; *Our Common Future*. New York: Oxford Univ Press, 1987.

[7] United Nations. Rio Earth Summit Agenda 21. Page 320. https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=23&menu=35.

[8] UNESCO (2015). *Education for all 2000–2015: Achievements and challenges. Education for All Global Monitoring Report*. Paris: UNESCO. http://unesdoc.unesco.org/images/0023/002322/232205e.pdf.

[9] For example, UNESCO.;1; 2014. Schooling can save the planet http://www.unesco.se/wp-content/uploads/2015/02/Education-transforms-lives.pdf.

[10] UN (2015). Sustainable development goals. Presented on the Sustainable development knowledge platform [interactive online resource]. New York: United Nations. Retrieved 12 September from https://sustainabledevelopment.un.org/?menu=1300.

and skills needed for environmentalism. For example, David Orr has argued that "…Education has long been a part of the problem, turning out graduates who were clueless about the way the world works as a physical system or why that knowledge was important to their lives and careers, while at the same time promoting knowledge of the sort that has fueled the destruction of ecologies and undermined human prospects."[11];

3. Theories supporting (or not) educational expansion as a means for environmental protection

One way that education could increase prioritization over economic growth, and could also change individual behavior, is by raising the subjective value a good environment. A second way it could change evaluations is that more educated people may better process evidence about the environment, even if they value it no more than those with less education. However, because schooling increases personal income, it also increases consumption, which – ceteris paribus – leads to increased greenhouse gas emissions.[12] For example, in Brazil emissions per household increased 23% from 2003 to 2009 due to increased consumption, driven by increased household income.[13] Although in the 1990s, there were some who suggested an inverted U-shaped curve for pollution with economic growth over time, a recent consensus has been that there is no such "Environmental Kuznets Curve" similar to the classic finding about the relation between income inequality and growth.[14] And, yet again, even though further school expansion will raise consumption, the net impact of education could be to reduce the carbon footprint and protect the environment if educated citizens make better choices how to spend their additional income. Is there any basis to suspect a countervailing effect education?

Underlying a hope that expanded schooling ultimately will promote environmental sustainability, there are two separate theories about how schools effect individual and social change: cognitive change and normative change. Literacy, numeracy, and other information processing skills are learned in schools either from the formal or informal curriculum. Schooling raises (tested) intelligence.[15] The evidence for climate change could be more comprehensible for those with more schooling. Comprehension could shape individuals' environmental attitudes and, ultimately, their behavior. From a different theoretical perspective, schools are seen as conduits of accepted values. Sociologists beginning with Emile Durkheim stressed the moral purposes of schooling. Beyond decoding skills and information, schools also impart shared social norms, while expanding children's conceptions of their community from family to a larger sphere (potentially even to a global community).[16]

Both theories would suppose there to be direct effects of education on concern for the environment. This supposition has found support based on regression discontinuity analysis in Europe[17] and other countries.[18] Examing the historical timing of school expansion and environmental concern in Thailand, for example, Muttarak and Chankrajang concluded that

> The level of concern about climate change is greater among individuals with higher education. More highly educated individuals generally have better understanding of scientific knowledge and familiarity with a range of issues. Since greater knowledge about climate change is positively correlated with concern about climate change, this consequently can explain the positive relationship between educational attainment and climate change concern.[19]

Notwithstanding this finding for Thailand, there is no global evidence that cognitive growth actually has lead to greater environmental concern. In most countries participating in the OECD's Program for International Student Assessment (PISA), 15-year-old's feelings of responsibilty for the environmental appear to be unrelated to their scientific knowledge about the environment. Researchers found positive as well as negative correlations within different countries. As a whole, in all countries together there was "no strong association between the index of students' sense of responsibility for environmental issues and their environmental science performance index, after accounting for student and school characteristics".[20] Likewise, a multi-level model of private and public environomental behaviors, based on 2010 International Social Survey Program (ISSP) data from 30 countries, confirmed that behaviors were positively associated with individual concern for the environment, and this was found across countries regardless of their level of economic development. The investigation found no support, however, for an independent country-level effect of education. Nor was there any link discovered between behaviors and country-level environmental damage.[21]

Apart from theories in support of a direct relationship between education and environmental prioritization, there is an alternative possible origin for attitudes toward the environment. It seems clear, at least in some countries, that expressed attitudes reflect social identity more than they reflect either comprehension of, or values about, the environment. In the United States, political identification is "by far the strongest predictor" of environmental concern.[22] Illustrating this in the case of the US, where the President recently announced that the country would not comply with the Paris Climate Accord, we should consider the sober message of ongoing surveys from the Pew Research Center. Pew data since 1992 are summarized in Fig. 1. As can be appreciated from Fig. 1, in the US party identity has become the most salient factor in views about the environment. By contrast, whether or not Americans finished postsecondary education consistently was not related to whether they believed "There need to be stricter laws and regulations to protect the environment."

From this alternative perspective, judgements appear to be based on interpretive frames and mental models of reality, rather than information. The skills to access and to process information are therefore scarcely relevant, from this perspective. Using an example from Colonial Virginia, the 2015 World Development Report interpreted the inability of Jamestown settlers to accept evidence that their new climate was much colder than their prior expectation. Despite starvation and failed harvests, colonists continued to plant crops in the erroneos belief that Virginia should resemble Meditareanean Europe, which is at the same latitude.[23] The same resistence to information can be seen

[11] Orr, D. *Down to the Wire: Confronting Climate Collapse*. New York: Oxford University Press, 2009.

[12] Ehrhardt-Martinez, K. and Schor, J. "Consumption and Climate Change". Pps. 93–126 in R.Dunlap and R. Brulle (eds.) *Climate Change and Society: Report of the American Sociological Associations Task Force on Sociology and Global Climate Change*. New York: Oxford University Press 2015.

[13] Perobelli, F., Rodrigues Faria, W., Vale, V. The increase in Brazilian household income and its impact on CO2 emissions. *Energy Economics* 52: 228–239 https://doi.org/10.1016/j.eneco.2015.10.007.

[14] Stern, David I. 2004. The Rise and Fall of the Environmental Kuznets Curve. *World Development* 32:1419-1439.

[15] Carlsson, M., Dahl, G., Björn Öckert, B. and Rooth, D. 2015. The effect of schooling on cognitive skills. *Review of Economics and Statistics* 97:533–547.

[16] Hyman, H., and Wright, C. 1979. *Education's Lasting Influence on Values*. Chicago: University of Chicago Press Running, K. 2013. World Citizenship and Concern for Global Warming. *Social Forces* 92:377–399, 10.1093/sf/sot077 https://doi.org/10.1093/sf/sot077.

[17] Meyer, A. 2015. Does education increase pro-environmental behavior? Evidence from Europe. *Ecological Economics* 116:108–121.

[18] Chankrajang, T. and Muttarak, R. 2017. Green Returns to Education: Does Schooling Contribute to Pro-Environmental Behaviours? Evidence from Thailand. *Ecological Economics* 131: 434–448 https://doi.org/10.1016/j.ecolecon.2016.09.015.

[19] Muttarak, R. and Chankrajang, T. Demographic Differentials in the Concern about Climate Change and Engagement in Climate-friendly Behaviours. International Institute for Applied Systems Analysis Working Paper IR-14-018 (2014).

[20] OECD. *Green at Fifteen? How 15-Year-Olds Perform in Environmental Science and Geoscience in PISA 2006* (2009) http://www.oecd-ilibrary.org/education/green-at-fifteen_978926406.

[21] Piasano, I., Lubell, M. Environmental Behavior in Cross-National Perspective: A Multilevel Analysis of 30 Countries. *Environment and Behavior* 1–28 (2015).

[22] Shwom, R. and A. McCright. 2015. "Public opinion on climate change." Pps. 269–299 in R. Dunlap and R. Brulle (eds.) *Climate Change and Society: Report of the American Sociological Associations Task Force on Sociology and Global Climate Change*. New York: Oxford University Press.

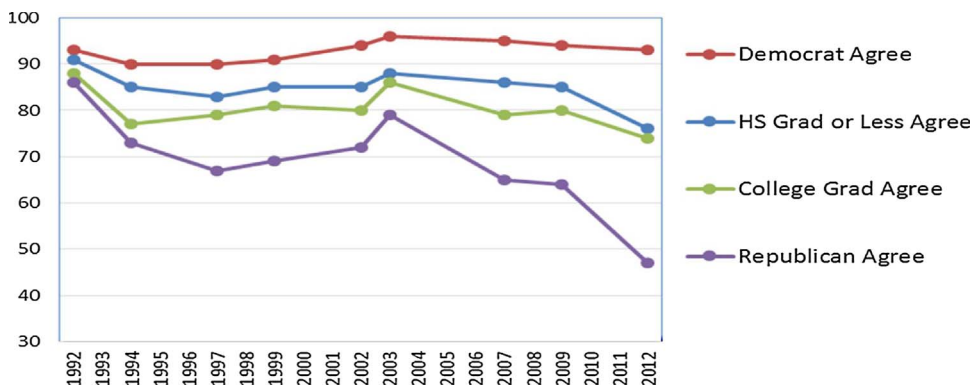[23] World Development Report 2015, *Mind, Society, and Behavior*.

Fig. 1. Percentages of US Adults Who Believe that "There need to be stricter laws and regulations to protect the environment," by education level and political party affiliation.
Source: Pew Research Center American Values Surveys

today. Cross-national research based on the World Values Survey's previous measure of general environmental concern finds that objective conditions are less important than are subjective value orientations.[24]

As can be appreciated from Fig. 1, in the United States individuals' identities drive their commitments, a charateristic that has been observed since the early 1950s.[25] Even US science teachers apparently base teaching about climate change more on their political identification than on their scientific knowledge.[26] Concern over global warming, in particular, seems to be associated with national identity outside the US as well. Respondents to the World Values Survey who identify themselves as a "world citizen" (rather than a national citizen) are most likely to be concerned about global warming.[27] According to Kahane and his colleagues:

> What guides individual risk perception… is not the truth of those beliefs but rather their congruence with individuals' cultural commitments. As a result, if beliefs about a societal risk such as climate change come to bear meanings congenial to some cultural outlooks but hostile to others, individuals motivated to adopt culturally congruent risk perceptions will fail to converge…. Simply improving the clarity of scientific information will not dispel public conflict so long as the climate-change debate continues to feature cultural meanings that divide citizens of opposing world-views.[28]

The two opposing perspectives on the origin of environmental concern − educational attainment and social identity – lead to different expectations about whether or not universalizing secondary education (a target of the SDGs) would in fact increase public concern for environmental sustainability. There is mixed support for this expectation in the existing Pew Surveys. Fig. 2 presents all Pew sampled countries where there were low levels of overall education attainment. On the right side of the graphic, we show the countries where respondents with secondary schooling were most concerned about climate change, as compared to respondents without secondary. But on the left side we can notice countries in which those with secondary education were actually *less* concerned than respondents who had no secondary schooling.

4. Environmental priorities in wave 6 of the world values survey

From 2010 through 2014, the sixth wave of the World Values Survey was fielded in 53 countries. Representative samples of about 1000 adults in these nations answered translated questions about values and behaviors.

The following analysis is based on 50 countries where there is complete information about respondents' preferences for environmental protection over economic growth, and there is also information about the contemporaneous as GDP/capita, per capita emission of carbon dioxide (CO_2), and emissions of particulates (PM2.5). First, replicating Pew Surveys about education's relation to concern for climate change, we cross-tabulated secondary school attainment with environmental prioritization. Fig. 3 graphs a selection of WVS countries showing the percentages of adults who agreed or agreed strongly with the following statement: "Protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs." As in Fig. 2, above, we present the results simply to illustrate there are countries like Sweden, Australia, New Zealand, and Romania, where adults who completed secondary schooling prioritzed the environment more than did those who had not finished secondary. But there are other countries − including Thailand, Russia, the United States, and South Korea − where there is either no relation or a negative relationship between prioritization and education.

5. Methods and data

The WVS was based on a stratified random household sampling scheme with a minimum number of 1000 respondents. Respondents are representative of the national adult population. Individuals younger than 18 years were not included in the WVS. We used country-level indicators of national wealth categories, and emissions of CO_2 and PM2.5 that are accessible from the World Bank. For countries with multiple years' records, we used a mean value corresponding to the time period when the WVS was fielded in that country. After merging these two sources and deleting countries and cases with missing values, we were left with a sample of 57762 individuals in 50 countries with full information about environmental prioritization, environmental political action, education, national wealth, and national emissions. Appendix A, Table A1 presents the nation-level means of indicators used in our analysis as well as the final sample size of the individual respondents older than 22.

The sampling scheme in the World Value Survey creates a multilevel dependency among individual observations. Individual differences in educational attainment, as well as environmental prioritization, are nested in the variations between their sampled countries, including variations in the quality of their national environment and their national wealth. The aim of this research was to estimate possible effects of education on the prioritization of the environment over economic growth, as well as the effects of education on environmental action, net of national differences in pollution and national wealth. To make this comparison, we estimated the effects of individual education attainment in the first level of our model, using age and sex as control variables. In the second level, we use emissions of CO_2, PM2.5 and national wealth as further explanatory variables predicting environmental prioritization and behavior.

The dependent variable in our first model – showing the association between education and environmental values – is a based on item V81 of the WVS. Respondents were asked the following question: *"Here are two statements people sometimes make when discussing the environment and*

[24] Dorsch, M. T. 2014. Economic Development and Determinants of Environmental Concern. *Social Science Quarterly* 95: 960–977. 10.1111/ssqu.12071

[25] Foote, N. 1951. "Identification as the Basis for a Theory of Motivation." *American Sociological Review* 16:14-21.

[26] Plutzer, E. et al. "Climate confusion among U.S. teachers," *Science* 12 February 2016. 10.1126/science.aab3907

[27] Running, Katrina 2013. World Citizenship and Concern for Global Warming. *Social Forces* 92:377–399, 10.1093/sf/sot077

[28] Kahan, D., Peters, E., Wittlin, M., Slovic, P., Larrimore, L., Braman, D. and Mandelet, G. 2012. "The polarizing impact of science literacy and numeracy on perceived climate change risks." *Nature: Climate Change* 2, 732–73 10.1038/nclimate1547.
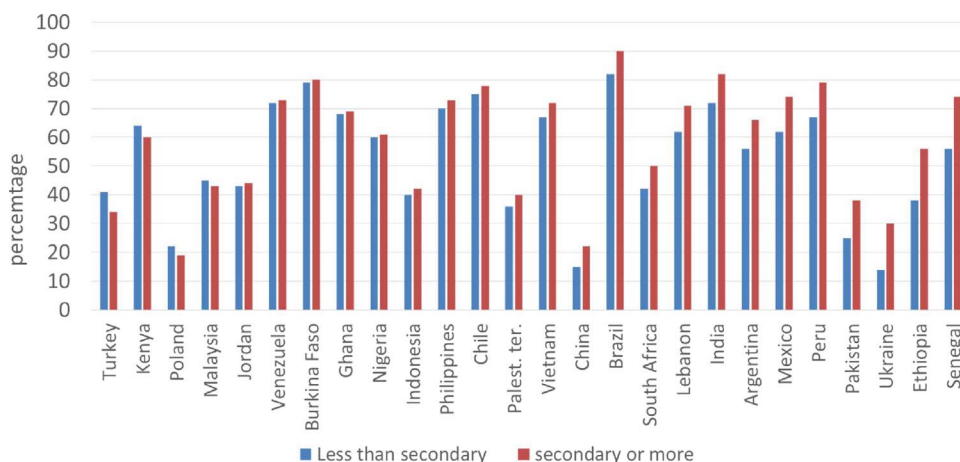
Fig. 2. Adults who respond that "global climate change is a very serious problem," by final level of education.
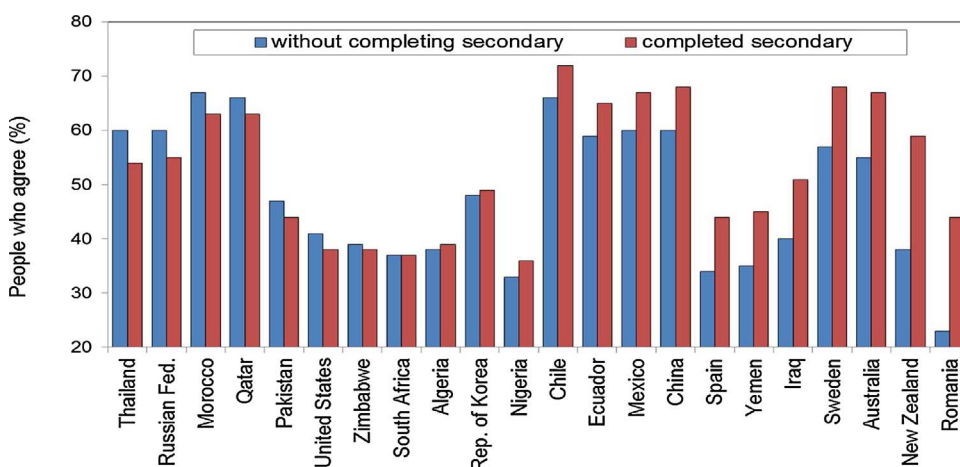

Fig. 3. Percentages who agree that "Protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs".

Note: Countries are ordered by differences between secondary and below-secondary attainment. Source: World Values Survey 2010–2014.

economic growth. Which of them comes closer to your own point of view?" Our estimates of the effects of independent variables show the association of these variables with the odds that respondents agree with the statement that "protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs." The alternative was that "economic growth and creating jobs should be the top priority, even if the environment suffers to some extent." About 10 percent of the respondents did not state their agreement on either of the two options, but gave some other response. These ambiguous respondents were not included in our analysis. We created a dichotomous dependent variable, coded as 1 to indicate that participants prioritize the environment over economic growth. The reference group was coded as 0 for respondents who prioritize economic growth over the environment. The dependent variables of our second model were three self-reported behaviors: whether or not the respondent had recently donated money to an environmental cause, whether or not they had participated in a political demonstration for the environment, and whether or not they had joined an environmental organization.

Our main independent variable of interest is the respondent's educational attainment. We created an indicator that could meaningfully be compared cross-nationally. We recoded education attainment into three mutually exclusive categories: less than complete secondary education; secondary education degree complete (including technical and vocational secondary completion, and with the possibility of some incomplete postsecondary); and complete postsecondary. In our models we estimated the effects of secondary and postsecondary education as binary variables, using "less than secondary" as the excluded reference category.

Other individual-level controls were age and gender. We used the WVS indicator of the respondent's age, but we restricted the national analytic samples to adults who were older than 22 in order that more respondents had

the opportunity to complete postsecondary school. Including younger respondents in the analysis could have confounded the effects of age and educational attainment. We also controlled for the respondent's sex, which was entered as a binary categorical variable where the reference group is male.

At the national level, we introduced three controls. The first two of these indicate different types of air pollution. Our indicator of PM2.5 comes from emissions data housed at the World Bank and based on the work by Brauer and his colleagues at the University of Washington.[29] PM2.5 air pollution is defined as the average level of exposure of a nation's population to concentrations of suspended particles measuring less than 2.5 μm in aerodynamic diameter. PM2.5 air pollution is measured in micrograms per cubic meter which is a weighted mean of annual concentrations of PM2.5 by population in both urban and rural areas. Particulates are a major cause of health problems in many of the world's cities. We expected that respondents from very polluted countries would tend to prioritize the environment over their national economy.

The second national level control is the country's annual emission of CO_2. We also retrieved these data from the World Bank Open Data archive.[30] The data originated from the Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory. CO_2 emissions are the byproducts of fossil fuel combustion, biomass burning, cement manufacture, and other industrial processes. Measured in metric tons per capita, CO_2 is the main anthropogenic greenhouse gas driver of global

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[29] Brauer, M. et al. (2016). "Ambient Air Pollution Exposure Estimation for the Global Burden of Disease 2013." *Environmental Science & Technology* 50: 79–88. PM2.5 air pollution, mean annual exposure (micrograms per cubic meter) (2016). Retrieved from: http://data.worldbank.org/indicator/EN·ATM.PM25. MC·M₃.

[30] http://data.worldbank.org/indicator/EN·ATM.CO₂E·PC.

Table 1

Individual-level Effects (Odds Ratios) of Education, and National-level effects of National Wealth and Pollution, on Prioritizing Environment over Economic Growth.
Source: Multi-level analysis of World Values Surveys of 2010-14.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Completed secondary education	1.1514***	1.1218***	1.1492***	1.1661***	1.1242***	1.1703***	1.0339
Completed postsecondary	1.5259***	1.4787***	1.5285***	1.5429***	1.4849***	1.4506***	1.6143***
Female	1.0390*	1.0381*	1.0403*	1.0431*	1.0306	1.0427*	1.0401*
Age	1.0011	1.0005	1.0012*	1.0013*	1.001	1.0014*	1.0012*
National per capita emissions CO_2	.9376***		.9440***	.9173***		.9114***	
National per capita emissions PM2.5		1.0060***	1.0046***		1.0022		0.9987
National income (ref. group is poorest)							
Lower Middle Income				1.7730***	1.6579***	1.7858***	1.6899***
Upper Middle Income				2.2311***	1.9506***	2.2502***	1.9096***
High Income Group				1.8048***	1.4101***	1.8212***	1.4091***
Interactions of Education-Pollution							
University Complete* CO_2						1.0242	
Secondary Education* CO_2						1.0015	
Postsecondary Ed.* PM2.5							0.9945
Secondary Ed* PM2.5							1.0052*

*p < 0.05, **p < 0.01, ***p < 0.001 Samples were restricted to respondents ages 23 and older.

warming. We expected that education would have a greater association with environmental prioritization and behavior among respondents who lived in countries with greater emissions of CO_2.

A third control variable at the national-level is the country's grouping in terms of national wealth. The World Bank classifies countries into one of four categories based on national per capita income and other information: low, lower-middle, upper-middle, and high.[31] One of the benefits of using this classification is that this indicator measures not only economic conditions but also such nonmonetary welfare measures as life expectancy and children's mortality. We estimated the effects of each of the World Bank's top three categories in the equations reported in Table 1, using the low-income countries as the omitted reference group. Effects of each of the top three categories show the additional likelihood of prioritizing the environment or taking environmental action that are associated with living in one of these countries as compared to respondents living in the poorest countries. Based on past research, we expected that respondents in poorer countries would be less concerned about environment than they would be concerned about job creation and their national economy.

6. Multi-level modeling

To produce the Odds Ratios shown below in Table 1. for the association between education and environmental prioritization, we estimated a two-level logistic regression model of prioritization because of the relationship of multilevel data with nonlinear structure models and non-normally distributed errors.

$$Ln (\pi_{ij}/1-\pi_{ij}) = \eta_{ij} = \beta_{0j} + \beta_{1j} (\text{Education Attainment})_{ij} + \beta_{2j} (\text{Age})_{ij} + \beta_{3j} (\text{Sex})_{ij}$$

where η_{ij} is the log of the odds of agreement with the statement that protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs. π_{ij} is the probability that people would prefer protecting environment. β_{0j} is the mean of log odds that the respondent would prioritize the environment over economic growth when other variables (Education attainment, Age, and Sex), and μ_{0j} are considered as zero. B_{pj} (p > 0) is the effect on log-odds of a one-unit increase in variables for individuals in the same country.

At the second level, we modeled the intercept as random and the remaining coefficients as fixed:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} (\text{PM2.5}/CO_2) + \gamma_{02} (\text{Economic indicator}) + \mu_{0j}$$

$$\beta_{pj} = \gamma_{p0} \text{ for } p > 0$$

where γ_{00} is the average log-odds of prioritizing the environment, γ_{p0} is the effect of countries' emissions and wealth classification on the respondent's agreement about prioritization, holding constant the other predictors in the model and the random country effect, μ_{0j}.

Further, in order to explore the national-level effect of environmental conditions on prioritization of the environment over the economic, we model the second level as

$$B_{pj} = \gamma_{p0} + \gamma_{p1} (\text{PM2.5}/CO_2) + \mu_{pj} \text{ for } p = 1$$

$$\beta_{pj} = \gamma_{p0} \text{ for } p = 2,3.$$

Lastly, we used three different dependent variables available in the WVS to explore whether environmental prioritization and education attainment are both associated with a greater likelihood that respondents will: join an environmental group; make a donation to an environmental cause; or join an environmental protest. These three dependent variables are tested separately in three multilevel logistic models, which are the same as in the previous model, but which in addition include whether or not the respondent prioritizes the environment in the first level of the model. However, we did not include the respondent's national wealth classification because this was not found to be statistically significant in exploratory analysis.

7. Results and discussion

The bivariate international differences between education and environmental prioritization over economic growth, seen previously in Fig. 3, reflect national contextual variations in pollution as well as national contextual differences between respondents' particular local economies. We therefore estimated multi-level models for the odds that respondents would agree environmental protection should be prioritized over economic growth. Our central question was whether we could find evidence of any net effect of either secondary or post-secondary education, once taking into account national contextual differences. At the individual level, we included only gender and age as controls.[32] Then, at the country-level,

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[31] https://datahelpdesk.worldbank.org/knowledgebase/articles/378834-how-does-the-world-bank-classify-countries.

[32] Individual income is not available in the WVS (nor is social class origin). But respondents' *subjective* social class was queried, as well as subjective views of their economic security. Exploratory research suggested that identifying with the upper-class and feeling secure are also associated with greater likelihood of prioritizing the environment.

we included two very different indicators of environmental damage: CO_2 production per capita, and PM2.5 per capita. CO_2 production is the main cause of climate change but is invisible and has no specific local consequence, whereas local emission of particulates (measured by PM2.5) visibly pollutes respondents' immediate surroundings and causes many diseases.[33] We also included an indicator of national income, as categorized by the World Bank. Finally we tested for interactions of educational attainment with emissions. Multi-level logistic regression model estimates are presented in Table 1.

The first finding apparent from Table 1, seen from the Odds Ratios shown in Model 1, Model 2, and Model 3, is that respondents who finished secondary and post-secondary education were more likely to prioritize the environment over economic growth after taking account of their country's CO_2 and particulates. The effect is modest for secondary, but statistically significant. Completing post-secondary education is associated with a much larger effect. Women and older people were slightly more likely to prioritize the environment over the economy. The modest effect of age in some models is due entirely to greater prioritization by those aged 40 and older, and not to increasing prioritization up to 40.[34]

Though not the main focus of our investigation, we should note that in Models 1–3 there are apparently opposite effects from the emissions of CO_2 and PM2.5: whether they are entered separately or together in Model 3, the odds ratio for the effect of living in a high CO_2 nation is less than 1.0, but the odds ratio associated with living in a nation with high PM2.5 output is greater than 1.0. In other words, ceteris paribus, living in a country that produces more CO_2 actually *reduces* the odds that respondents to the WVS would prioritize the environment over economic growth. This disturbing finding is consistent with previous investigations about general concern for climate change and for the environment, based on earlier international surveys. But the positive effect of particulate emission – which has local as opposed to global consequences – indicates that respondents act in accord with their health interests when there is daily reminder of damage to the environment that is visible and immediately hazardous. To our knowledge this finding has not been reported previously.

There are also country-level effects of living in a higher income nation, as can be appreciated from the significant Odds Ratios reported under Models 4–7. The reference group in the model is the poorest countries of the World Bank grouping. As compared to respondents from these poorest countries, those who lived in the top three groups of countries were all more likely to prioritize environmental protections over economic growth. Put differently, those living in the poorest countries were most likely to disagree that protecting the environment was more important than growing their economy and protecting jobs.

Including the indicator of country income level in our models is useful because it shows that the effects of education are not artifacts of living in a wealthy country, even though respondents from the "High Income" group also had completed more education. Note that the Odds Ratios for the effect of education remain virtually unchanged after taking account the income classification of the respondent's country. Note, also, that the effect of national wealth is due to living in a country that is not "poor." Respondents in the top three categories of countries were more likely to prioritize the environement over their national economies, as compared to respondents living in the poorest countries. But respondents from "High Income" countries were no less likely to prioritize economic growth, and no more likely to prioritize the environment, than were respondents in the "Middle Income" countries.

Table 1 under Models 6 and 7, reports interaction terms for education with emissions of CO_2 and PM2.5. We found no statistically significant interaction either of secondary or postsecondary education with a nation's production of CO_2. This means that education's positive effect is not dependent on living in a country which produces more greenhouse gas, which is unsurprising given that Carbon Dioxide has no local effect. More surprising is the lack of any signficant interaction between postsecondary education and PM2.5. It is possible that respondents with postsecondary education in highly polluted countries already priotize their environments to such an extent that local pollution makes no further difference. However, the main effect of secondary education appeared to become statistically insignificant when its statistically significant interation with PM2.5 was included. In other words, respondents who completed secondary school tended to favor environmental protection *only if they lived in countries with a large amount of visible particulate pollution.*

8. Does prioritization of the environment make any difference in behavior?

The World Values Survey included three questions about personal and political activities that are relevant to environmental behaviors: whether the respondent had donated money to an environmental cause; had participated in a political demonstration for the environment; and had joined an environmental organization. We investigated whether these actions were associated with the respondent's educational attainment directly, and whether they were also linked to the individual's prioritization of the environment. Table 2. presents the Odds Ratios for individual-level and country-level variables based on multi-level logistic regression model estimates. For each of three self-reported actions, we estimated the effect of education and also the prioritization as indicated by the response to question V81 (discussed previously). As in our previous models, we included a second level where we estimated the association with emissions in the nation of the respondent.

The findings presented in Table 2. suggest that education matters both directly and indirectly for the three pro-environmental behaviors captured by the WVS. Respondents with secondary and post-secondary education (and respondents who prioritize environmental protection over economic growth as a result of their education) are more likely to take pro-environmental actions. That is, even after taking account of individual-level prioritization of the environment, respondents who finished secondary schooling were likely to report all three pro-environmental actions, and those with post-secondary education were even more likely. Women were slightly less likely than men to participate in demonstrations or join an organization, and older respondents were slightly more likely than young people to donate money or join a demonstration.

In exploratory analysis we found that national income had no statistically significant effect (and so is not included in our final models to save space). However, a nation's production of PM2.5 was found to be positively associated with donating money to an environmental organization, while negatively associated with joining a demonstration or a pro-environmental organization. CO_2 production is positively associated with participation in demonstrations and joining an organization. People are motivated directly by the condition of their environment, but in heavily polluted countries with high emissions of PM2.5 (which are often authoritarian countries) there is a negative associaton with pro-environmental public action (although this is not the case for less-public donations to an environmental cause).

9. Future directions and conclusions

Steering the course of climate change will require coordination and collective action between nations, which are directed not only by the interests of their political leaders and elites but also the values and behaviors of individual citizens. As such, it is essential to understand the potential impact of expanded schooling and the SDG's target of universalizing secondary. The investigation reported here can only begin to suggest the

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[33] World Health Organization 2016. *Ambient Air Pollution: A global assessment of exposure and burden of disease.* Geneva: WHO. http://who.int/phe/publications/air-pollution-global-assessment/en/.

[34] In other analysis not reported here, we found no statisically significant interaction between education level and age. In other words, whatever the effects of education, they are stable across birth cohorts. This would be surprising if education affected values through the curriculum, since in recent years schools have paid more attention to the environmentment. However, the finding is less surprising if education operates by increasing information processing and interpretation of changes in the world.

Table 2
Individual-level and National-level Determinants of Three Pro-Environment Activities (Odds Ratios).
Source: Multi-level analysis of World Values Surveys of 2010–14.

	Donated money to an environmental cause	Participated in political demonstration for environment	Joined an environmental protection organization
Prioritizes environment over economy	1.7822***	1.7378***	1.4558***
Secondary education	1.4537***	1.3194***	1.2817***
Postsecondary education	2.2736***	1.8643***	1.9843***
Female	0.9576	.8477***	.8047***
Age (above 22)	1.0080***	.9944***	0.9990
National CO_2 emissions per capita	1.0192	1.1492	1.3614**
National PM2.5 emissions per capita	1.1322***	.9558**	.9167***

*p < 0.05.
**p < 0.01.
***p < 0.001.

Fig. 4. General Theoretical Model of Education, Environmental Values, and Behavior.
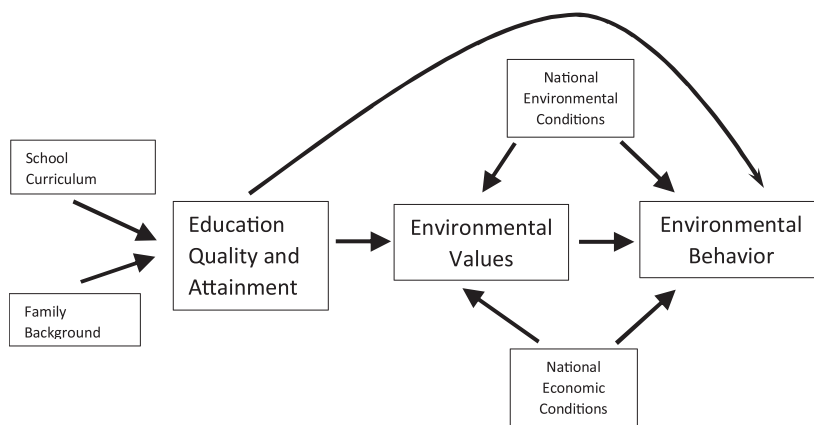
nature of the relationships between education, values, and action for the environment. It is limited in two respects by the available survey data.

First, the WVS does not allow us to investigate the effect of *changes* in education on *changes* in the values of individual or *changes* in their actions. The WVS is a one-time snapshot of educational attainment, current values, and recent (self-reported) actions. Other research will need to identify effects of education for individuals within a birth cohort in order to establish causality. Second, the WVS is also limited with regard to omitted variables that lead to educational attainment. We can not be certain that the associations reported in Tables 1 and 2 are ultimately caused by the respondent's education, as opposed to the family and social origins that are associated with educational attainment. One could speculate, for example, that adults who were raised in more advantaged homes acquired not only more education but also the tools for understanding environmental problems, and the responsibility for civic participation. Further cross-national survey research will be needed that queries the social origins of respondents and retrospective information about their childhoods.

Despite its limitations, cross-national survey research is highly suggestive − and supportive − of the suspected linkage between education and environmentalism. Wide international variations are evident in the relationships between education and environmental prioritization. And yet, overall, we found evidence that suggests a modest positive association of secondary school attainment, and a much larger effect of postsecondary schooling once including other individual and national context factors in our models. It is possible formal schooling increases respondents valuation of a sustainable environment, although there is little direct evidence for such an increase. Respondents in countries with greater CO_2 emissions actually have lower likelihoods of prioritizing the environment, and our finding that education has no interaction with CO_2 emissions does not suggest schools have enculcated environmental values. There is more support for the possibility that formal education improve the decoding and synthesizing of evidence about the environment when daily life is affected, as seen from the positive interaction of secondary schooling with PM2.5. The fact that there

is no such positive interaction with CO_2 emission could be due to the invisibility of a local effect, at least for many people in the world.

Our findings lend support to further investigations that use a general theoretical model for the relationship between education and environmental action. Our proposed model (see Fig. 4) would include family and contextual influences on school attainment, national environmental and economic influences on values, and then the direct and indirect effects of schooling and family background on environmental behaviors. Although there is not likely to be any single data source that permits researchers to investigate all of the linkages within this general model, we hope that future investigations will take incremental progress by focusing on links of the causal chain. We see our contribution as necessary to suggest fruitful areas for research within this general model.

Our finding that respondents from the poorest country group were more likely to prioritize economic growth over the environment makes sense from the perspective of World Values researchers who have found that post-materialist values, such as a health environment, emerge comes after societies achieve economic security.[35] However, our finding that the effect is not linear is also important. There is no evidence that respondents from the richest country grouping valued environmental protection more then did respondents from the second or third grouping. This lends support to researchers who find that affluence is not essential for environmental concern.[36]

The fact that the respondents living in countries of greatest CO_2 production are least likely to prioritize the environment is very

[35] Inglehart R. and C. Welzel 2005. *Modernization, Cultural Change, and Democracy: The Human Development Sequence*. New York: Cambridge University Press. Inglehart, R., 1995. Public support for environmental protection: objective problems and subjective values in 43 societies. *Political Science and Politics* 28:57–72.
[36] Dunlap, R. E. and York, R. 2008. The globalization of environmental concern and the limits of the postmaterialist values explanation: evidence from four multinational surveys. *Sociological Quarterly* 49: 529–563. doi:10.1111/j.1533-8525.2008.00127.x

troubling. However, this negative relation is consistent with previous research.[37] Perhaps the knowledge that one lives in a country producing greenhouse gases is so troubling that it leads respondents to psychological denial, and to downplay danger.[38] But particulate pollution is less possible to ignore or to deny, which probably explains is positive direct effects and positive interactions with secondary schooling.

In conclusion, we return to our initial question of whether schooling can play a positive role protecting the environment and slowing climate change. Within the limits of WVS data, we believe we have found evidence that schooling – even existing schooling – can possibly help, although this is less likely in countries like the United States where political identity has become the overriding factor in one's stance toward the environment. The larger question, in the race between the consumption effects and environmental action effects of education, is whether education can have a quick-enough impact to compensate for its evident increase in consumption and the carbon footprint.

Appendix A

Table A1
Countries Selected For Analysis and National Level Variables.

Country	Number Participants from each Country	National Income Group	CO_2 tons/capita	PM2.5
Algeria	746	Upper-Middle	0.88	19.16
Argentina	778	High	1.27	9.42
Armenia	892	Lower-Middle	0.46	20.57
Australia	993	High	4.43	6.60
Azerbaijan	856	Upper-Middle	0.99	21.38
Belarus	1294	Upper-Middle	1.83	13.76
Chile	815	High	1.25	18.77
China	1788	Upper-Middle	1.8	54.11
Colombia	1249	Upper-Middle	0.42	11.81
Cyprus	805	High	1.84	17.34
Ecuador	982	Upper-Middle	0.64	11.38
Egypt	1347	Lower-Middle	0.76	35.20
Estonia	1277	High	3.93	9.42
Germany	1666	High	2.4	15.85
Ghana	1100	Lower-Middle	0.11	23.49
Iraq	919	Upper-Middle	1.14	35.09
Japan	1212	High	2.54	16.62
Jordan	978	Upper-Middle	0.9	26.18
Kazakhstan	1290	Upper-Middle	4.43	14.80
Kuwait	953	High	7.94	46.98
Kyrgyzstan	1238	Lower-Middle	0.33	18.02
Lebanon	903	Upper-Middle	1.25	23.24
Malaysia	1083	Upper-Middle	2.14	12.68
Mexico	1589	Upper-Middle	1.07	12.84
Morocco	805	Lower-Middle	0.48	16.90
Netherlands	1648	High	2.75	17.25
New Zealand	629	High	1.93	8.63
Nigeria	1345	Lower-Middle	0.15	28.55
Pakistan	943	Lower-Middle	0.25	43.78
Peru	862	Upper-Middle	0.49	11.53
Philippines	1069	Lower-Middle	0.24	8.83
Poland	787	High	2.26	17.93
Qatar	894	High	11.97	39.78
Romania	1291	Upper-Middle	1.06	17.83
Russia	1953	High	3.44	14.26
Rwanda	881	Low	0.02	15.96
Singapore	1627	High	1.18	13.12
Slovenia	857	High	2.04	15.44
South Africa	2948	Upper-Middle	2.51	14.31
Spain	998	High	1.59	12.57
Sweden	952	High	1.5	7.83
Thailand	1070	Upper-Middle	1.24	20.67
Tunisia	899	Upper-Middle	0.65	17.33
Turkey	1295	Upper-Middle	1.2	18.00
Ukraine	1278	Lower-Middle	1.7	15.78
United States	2033	High	4.54	11.60
Uruguay	807	High	0.63	6.59
Uzbekistan	1193	Lower-Middle	1.11	25.01
Yemen	731	Lower-Middle	0.26	33.76
Zimbabwe	1214	Low	0.2	8.54
Total	57,762			

[37] Sandvik, H. 2008. Public concern over global warming correlates negatively with national wealth. *Climatic Change* 90: 333. 10.1007/s10584-008-9429-6.
[38] Norgaard, K. *Living in Denial: Climate Change, Emotions and Everyday Life* MIT Press, 2011.